

REMARKS

Claims 1, 23 and 28 have been amended and new Claim 37 has been added. No new matter has been added.

Reply to Restriction Requirement

Responsive to the requirement for an election of species for searching purposes, Applicant hereby provisionally elects species II. Claims readable on the elected species are Claims 23-27 and new generic Claim 37.

Applicant reserves the right to file a continuing application or take such other appropriate action as deemed necessary to protect the non-elected inventions. Applicant does not hereby abandon or waive any rights in the non-elected inventions.

The present invention is directed toward the control of processing on materials, such as a heat treatment, where the material condition varies with process condition, such as temperature, and is monitored with electromagnetic sensors or sensor arrays, such as magnetic field based eddy-current sensors or electric field based dielectric sensors. The sensors monitor the material condition directly while the material is being exposed to the process conditions, rather than indirectly through monitoring of the control settings used for the process, such as the temperature of the oven during a heat treatment. Directly monitoring the material condition permits better process control since the processing is aimed at altering the material properties. This direct monitoring can be performed with sensors exposed to the same processing conditions or with sensors placed on the outside of a shielding layer that protects the sensor from the processing conditions. This type of direct material condition monitoring with eddy current sensors at elevated temperatures has not been demonstrated previously because of the typical eddy current sensor variation with temperature, the difficulty of calibrating these sensors at elevated temperatures, and, for the case of the shielding layers, the need to self-consistently monitor the properties of the shielding layer as well as the test material so that the measurement of the test material properties are not contaminated by property variations of the shielding layer.

The direct measurement of the material properties allows relationships to be determined between the material electrical property and the process condition. For example, under steady state conditions, the electrical conductivity of many metals varies linearly with temperature for a

relatively narrow temperature range. This type of relationship can be determined for the alloy of interest for steady state or transient conditions when the material properties are monitored directly. After establishing this relationship, any divergence between a measured property and a property estimated from the relationship can be used as part of the process control. This type of relationship can also be used for sensor calibration so that the sensor measurement data is adjusted to provide the correct electrical property for the imposed process condition.

The Examiner's attention is drawn to new Claim 37, which is directed to a method for calibrating a sensor for use in process control and is a generic claim that reads on the elected species and links all the species identified by the Examiner. If such a linking claim is found to be allowable, claims drawn to controlling material process, calibrating a sensor for use in process control, and calibrating the sensor in-situ, which are linked by that linking claim, should be rejoined.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

By *Lubashev*
Lyudmila Lubashev
Registration No. 55,408
Telephone: (978) 341-0036
Facsimile: (978) 341-0136

Concord, MA 01742-9133

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